

Application # 09/758,573
Submitted March 27, 2007
Reply to Office Action of September 27, 2006

III. REMARKS/ARGUMENTS

4. The Office Action dated September 27, 2007 has been carefully considered.

Reconsideration of this application, in view of the following remarks, is respectfully requested.

A. References

5. The following U.S. patents were considered in the office action:

- US Patent 6,592,629 ("Cullen"), filed November 13, 1997
- US Patent 5,696,940 (referred to as "Lin" in the office action, hereafter correctly referred to as "Liu"), filed September 29, 1995
- US Patent 5,828,856 ("Bowes"), filed March 21, 1996
- US Patent 6,338,119 ("Anderson"), filed March 31, 1999
- US Patent 6,084,598 ("Chekerylla", filed April 23, 1998

B. Overview of Office Action

6. The office action:

- a. rejected claims 1, 5-9, 11-20, 22, 23, 26, 27, 30-34 as being unpatentable over Liu in view of Chekerylla (and Bowes) under 35 U.S.C. 103(a),
- b. rejected claims 2-4 as being unpatentable over Liu in view of Chekerylla and in further view of Anderson (and Bowes and Wada) under 35 U.S.C. 103(a), and
- c. rejected claims 21, 24, 25, 28, and 29 as being unpatentable over Liu in view of Chekerylla and in further view of Cullen under 35 U.S.C. 103(a).

IV. CLAIM AMENDMENTS

7. Claims 1-4, 12, 16, 22, and 26 were amended to clarify the earlier definition of memory as "main memory" as discussed below. Claim 26 was amended to correct a clerical

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error and thus provide proper antecedent of "output device." None of these changes were made to overcome prior art.

V. DISTINCTION OVER PRIOR ART

C. Novel, Unrecognized Result: Faster Image Processing

8. The Title of this invention is "Faster Image Processing."

9. The Summary of Invention is "methods of increasing performance of image processing by copying image data between I/O memory and main memory where CPU intensive processing of the image data is more efficiently performed.

10. The stated objects of the invention, page 3, include:

- "(a) to provide efficient processing of image data prior to display on a computer display.
- (b) to provide efficient processing of image data being captured in real time with a video digitizer.
- (c) to reduce the time necessary to process the image data."

11. The discovered improvement and unexpected result is summarized at least in the "Processing Speed Improvement" second on page 6 of the specification, "When video data is being displayed or captured the storage (memory 103 or I/O RAM 220) holding the data is continually being accessed by the video display circuitry or video digitizing circuitry. Also the capture video RAM 113 and the display video RAM 120 typically is not cached by a CPU 101 in any cache (230 or 240), so when processing the video data for compression, encryption, enhancement, or decompression it is significantly faster to process the data in cacheable main memory." Further, page 7, states, "This invention discovered that is was much more efficient to

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write the decoded data to a [main] memory buffer 300 instead of writing it directly to image 310 in I/O RAM 220 as each pixel is processed."

12. Further, in the "Not Obvious" section on page 7, the specification explains, "The speed improvement yielded by this invention was not obvious to one skilled in the art of computer programming. The video data is large, up to 1.2 million bytes, and the time to copy it from one buffer to another generally is thought to be overhead that will decrease performance. This invention teaches that because of hardware lockout, collisions with the video circuitry, or the lack of data caching in the CPU cache 240 or memory cache 230, the extra copy can significantly reduce the processing time, and thus reduce the overall time required to process the data and to display or capture the video data."

13. Making an extra second copy of the data would have been considered to be overhead and adverse to performance.

D. Distinction Already Claimed

14. Each of the independent claims as *previously* written include claim language that require this aspect of the invention, which is not disclosed in the cited prior art, as follows:

Claim	Limitation(s)
Claim 1	...method of <u>increasing image processing performance</u> by explicitly copying... <u>I/O RAM into an extra second copy... in ... memory</u>
Claim 12	...method of <u>increasing image processing performance</u> by explicitly storing the processed results ... in ... <u>memory</u> prior to copying ... into a <u>distinct second copy</u> of ... in an <u>I/O RAM</u> , wherein the CPU results are written directly to... memory and not to the ... I/O RAM.
Claim 16	... copying image data between ... <u>memory</u> and said <u>I/O device</u> ... to a <u>second copy</u> ... <u>whereby image processing time is reduced.</u>
Claim 22	... <u>copying</u> said image data <u>from said input device</u> to a <u>second copy</u> ... in ... <u>memory</u> ..., whereby <u>image processing time is reduced</u> compared to the image processing time required if the processor processed the <u>first copy</u>
Claim 26	...copying, ... a <u>first set</u> ... in ... <u>memory</u> ... to a <u>second copy</u> ... in ... <u>output device, whereby image processing time is reduced</u> compared to the

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	image processing time required if the processor generated the image data directly in said input device instead of ... memory.
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E. Special Definitions

15. In the response dated February 16, 2005, special definitions were provided for the following claim terms:

buffer	a special area in main memory used to hold data temporarily for processing by a CPU
I/O RAM	a random access memory which is associated with an I/O device, and which is distinct from main memory
memory	main memory which is distinct from an I/O RAM, a CPU cache, or an external cache
memory copy function	a computer program that copies a block data between a memory address and another memory address

16. The claims have been amended to clarify this distinction regarding "main memory" and to more precisely distinguish between the various uses of the word "memory" in the specification and claims. These amendments were made to more distinctly claim the invention and not to overcome prior art. Applicant submits that this clarifying change does not change the scope of the claims because this implicit limitation was already made in the file history by the special definition provided over two years ago on February 16, 2005. Further, applicant submits that these changes by themselves do not require a new search, nor would they impose a burden on the examiner.

17. Accordingly the new special definition for "main memory" is rewritten as follows:

main memory	a memory which is distinct from an I/O RAM, a CPU cache, or an external cache
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F. Conventional Structural Elements

18. The Office Action relies on combinations of Liu, Chekerylla, Bowes, Anderson, Wada, and Cullen to provide teaching regarding many of the structural elements of the claimed methods, such I/O RAM, main memory buffers, CPU, cached memory, CPU caches, external caches, DMA circuitry, etc. Many of these structural elements were well known in the art (as discussed in the Background—Related Technology section of the specification and in reference to Figures 1A, 1B, 1C, 2A and 2B).

G. Novel Functionality and New Use of Convention Structure

19. The present invention claims novel methods and uses of convention structures. In particular, image processing performance may be increased by explicitly copying a an image existing in an I/O RAM into an extra second copy of said image in a buffer in main memory prior to performing CPU intensive operations on the data copied from said image.

20. Aspects of the present invention are further described in reference to Figures 4, 5, and 6.

H. Previous Prior Art and New Grounds: Chekerylla

21. In the previous office actions and responses the teachings of Liu, Bowes, Anderson, Wada, and Cullen have all be discussed and their teaching alone or in various combinations fail to the teach the novel aspects of the present invention. Applicant's earlier discussions regarding those prior art references are included herein by reference. The present office action adds Chekerylla to attempt to provide the missing teaching. However, Chekerylla alone or in various combinations still fails to teach the present invention as claimed.

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I. Overview of Chekerylla

22. Chekerylla is directed to a "plug-in image manipulation program 113" (Chekerylla, Fig 1, 8:65-9:2) which is preferably loaded by a "standard graphics program 111" such as Adobe Photoshop, which is supported by a Microsoft Windows environment, running on a conventional IBM PC-compatible computer. (See Chekerylla 6:34-37, 6:52-59, and 7:2-8)

23. Chekerylla teaches making various copies of a still graphic image for various functional reasons and not increase overall performance.

a. Original Image (e.g. Photoshop's copy)

24. The first copy of the digital image is the one contained in the standard graphics program, i.e. Photoshop. "The digital image is loaded into the RAM [main memory] 102 by program execution of the graphics program 111 as image data for the image manipulation program 113" (Chekerylla 9:19-20). Thus, unlike the present invention the first image is stored in main memory. "A camera 106, having an imager, or alternatively a network 105, the hard drive or other nonvolatile storage device 103, provides a digital image..." (Chekerylla 9:14-16).

25. The Photoshop copy in main memory is referred to as the "original image" (Chekerylla 10:58). This is the convention copy used by Photoshop or any other standard graphics program.

b. Plug-in "Unaltered" Copy

26. Chekerylla's plug-in 113 must have its own second copy so that it can provide the OK/Cancel functionality. "The computer program of this invention (referred to as 113 in FIG. 1) includes instructions that provide an OK control 211 to allow the user to accept any changes made and return to the parent graphics application while the CANCEL control 212 is provided

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by the application so that the user can return to the parent graphics application without making any changes to the original image." (Chekerylla 10:52-58, emphasis added).

27. "Referring to FIG. 6, the top-level program flow is shown for the preferred embodiment with the graphics manipulation program (referred to as 113 in FIG. 1) implemented as a plug-in. When the program is invoked, its executed instructions first create a copy of the currently-active image of the calling graphics application Then, the user's commands are processed 603 (see FIG. 7) until the user selects either OK or CANCEL 606. If the user terminates the program with OK 604, then the application copies the modified image back to the graphics manipulation program 605." (Chekerylla 11:33-43)

28. This copy is also used to provide part of the Toggle functionality "The TOGGLE control 807 results in the original, unaltered image being displayed while the TOGGLE control is depressed ..." (Chekerylla 12:11-13, emphasis added).

29. This copy is also used to provide the Restore functionality, and is referred to as the "unaltered image". "The RESTORE control 809 results in the original, unaltered image replacing the current altered image 810." (Chekerylla 12:14-16).

c. Plug-in "Altered Image 810" or "Current Image" Copy

30. Chekerylla's plug-in 113 must have a third copy so that it can display the most recently altered version of the image, and to provide the Restore and Toggle functionality. "The RESTORE control 809 results in the original, unaltered image replacing the current altered image 810." (Chekerylla 12:14-16). See also 13:19-21 and 13:62-65 regarding copying each image change to the image buffer.

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d. Plug-in Undo Copy

31. Chekerylla's plug-in 113 must have a fourth copy so that it can provide the Undo functionality. "The UNDO control 811 results in the most recent change being backed out 812 by the program." (Chekerylla 12:18-20). "When the user of the invention uses the controls to change an image, the values for the pixels in the affected area are replaced with new values in the copy of the image data stored in RAM. The original image data is always available in case the user wants to discard all of the changes made and start again with the original image. Also, whenever a change is made to an image, the entire most recent image data is first copied to an undo buffer so that the user of the invention has the option to discard the most recent change." (Chekerylla 6:13-21).

e. All Chekerylla Plug-in Copies in Main Memory

32. All four of the copies discussed above are stored in main memory (referred to as RAM).

33. "The computer program of this invention supports the 'undo' operation by saving a copy of the current image state in a pre-allocated RAM buffer before any change is applied to the current image. Then if the user wants to back a change out, the program copies the saved image back over the current image in RAM." (Chekerylla 8:39-45, emphasis added).

34. In this way, Chekerylla teaches away from the present invention as claimed. As shown in the claim table above, each of the independent claims require a copy in I/O RAM (which is distinct from main memory) and a copy in main memory.

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f. Camera Imager or Scanner Plug-in

35. Chekerylla vaguely teaches that the image can come from a camera 106 with an imager, but no details regarding the camera or the imager are provided. One of ordinary skill in the art would know that a PhotoShop plug-in or another graphic program could have been used to obtain the still graphic image being used by the standard graphics program (e.g. Photoshop). The copy from the camera to the PhotoShop image is made for operational reasons and not to improve overall image processing performance. Namely, PhotoShop needs to receive the data in a standard format before it can operate on the data.

J. Different Way Solves a Different Problem with Different Results

36. The copying taught by Chekerylla is not the same as required by the claims of the present invention. Further, each of the copies taught by Chekerylla are motivated by a operation requirement (not a performance requirement) and thus solve a different problem than is being solved by the present invention. Further, the results taught by Chekerylla are conventional in that they provide the expected operational result such as saving most recent changes, toggling the display, etc. The result required by the independent claims is that image processing performance is improved. This result is not taught by Chekerylla.

K. Chekerylla Teaches Away from the Present Invention

37. Chekerylla teaches away from present invention in a number of ways not yet discussed.

38. Chekerylla is limited to the processing a single still digital image. The speed at which a series of video image frames can be processed is not a concern for Chekerylla. In contrast, the present invention requires "a video digitizer" (claim 11), "a video signal ...

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digitized and encoded by at least one of said first machines, transmitted across said network (claim 21), and a state object of the invention is "to provide efficient processing of image data being captured in real time with a video digitizer". Chekerylla is limited to still image processing and thus could not suggest the claimed improvements. Further, the present invention was developed for use with such video compression, encryption, and transmissions systems (e.g. as disclosed, for example, in my other patents US 6,803,931, US 7,016,417, US 7,191,462 and co-pending applications published as WO 99/59472, and US 2006/0114987).

39. Additionally, Chekerylla teaches that "Operations are always performed on full image resolution..." (Chekerylla Abstract and 2:32-34). In this way to Chekerylla, too, teaches away from the present invention and its preferred embodiment. Fig. 4 shows copying of a subset of the full image. "In the preferred embodiment, only a subset image 310 of the data in I/O RAM 220 is of interest for processing, so the memory copy function is called repeatedly to copy each line of desired image data. For example if the desired subset is 320 by 240, the memory copy function is called 240 times and copies 320 pixels each time. This has the advantage of only copying the desired data. Even though there is more overhead in determining how to copy the subset and in calling the memory copy function multiple time, the time saved by copying less data more than compensates for the additional overhead. Less memory is used to hold the main memory buffer and less data must be processed." (Specification, page 8). This aspect of the invention is required, for example, by claims 8 and 9.

L. Combination of Lui with Chekerylla Still Fails

40. The office action combines Chekerylla with Lui (and Bowes by reference) in an attempt to invalidate the independent claims. The office action states "[Lui] fails to explicitly

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suggest or teach 'explicitly copying a first instance of an image into a second copy of said image in a buffer in the memory'. However this is what Chekerylla teaches..." (Office Action p. 3). However, the Office Action's identification of the missing teaching does not accurately state the required claim language of the independent claims as amended, i.e. "increasing image processing performance by explicitly copying a first instance of an image existing in an I/O RAM into an extra second copy of said image in a buffer in main memory prior to performing CPU intensive operations on the data copied from said image". As discussed above Chekerylla does not explicitly teach copying an image from I/O RAM to an extra second copy in main memory in order increase image processing performance. Instead, Chekerylla only teaches copies being made from main memory to main memory. Further Chekerylla motivation to make the copies is not to gain a non-obvious, non-functional but performance only benefit.

41. Thus, Chekerylla fails to provide the missing teaching.

M. Combinations Improper

42. The combination of Lui and Chekerylla is improper because it is an unsuggested combination. The prior art references do not contain any suggestion (express or implied) that they be combined, or that they be combined in the manner suggested. Lui is directed towards a FIFO device used a video I/O RAM while Chekerylla is directed toward standard graphics program plug-in which operates only with main memory buffers. Each of the references are independent and complete without each other. Further, each of the references solve a different problem in different ways with different results.

43. Further, even if Lui and Chekerylla were combined, the combination would fail to teach the claimed invention, as discussed above.

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44. Further, the office action implies that the motivation for the present invention is "to enhance image manipulation *without changing the original image*". This is not an object of the present invention. The present invention is directed only to increasing image processing performance and does not require that the original image (i.e. the image in the I/O RAM) be unchanged. Thus, the assumed motivation to combine is not present in the problem solved by the present invention.

45. Further, the combination with yet another reference, Bowes and/or Wada, is implied but not explicitly asserted as part of the combined references in the office action.

46. The other combinations with Anderson and Cullen also suffer from the same and similar flaws.

VI. CLAIM ELEMENTS WHICH DISTINGUISH OVER THE PRIOR ART NOT CLEARLY IDENTIFIED WITH CONVINCING REASONING

47. Each of the independent claims as amended contain language which distinctly claim the invention with language which distinguish the novel functionality and benefits of the present invention over the structural elements identified in the prior art combinations cited by the office action. As discussed in the following sections, the office action has not identified where these novel features are taught or suggested by the cited prior art.

Claim 1

48. Claim 1 claims a "method of increasing image processing performance by explicitly copying a first instance of an image existing in an I/O RAM into an extra second copy of said image in a buffer in main memory prior to performing CPU intensive operations on the data copied from said image, wherein the CPU access is made directly to the extra second copy of the data in main memory and not to the first instance in said I/O RAM." (emphasis added).

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49. The office action does not clearly show where the cited prior art teaches explicitly copying “an extra second copy” of a image that is already in I/O RAM, nor does it clearly show where the extra second copy is made by “explicitly copying ... prior to performing CPU intensive operations on the data copied” where “the CPU access is made directly to the extra second copy of the data in main memory.” Further the office action does not show where the prior art clearly teaches the discovery that taking the time and resources to make “an extra second copy” leads to the result of “increasing image procession performance” over convention methods. Thus the office action has not shown where subject matter of claim 1 as a whole, including its differences over the prior art, would have been obvious.

Claim 12

50. Claim 12 claims a “method of increasing image processing performance by explicitly storing the processed results of CPU intensive operations in a first instance of a buffer in main memory prior to copying the processed data into a distinct second copy of the processed data in an image in an I/O RAM, wherein the CPU results are written directly to the first instance of the processed data in main memory and not to the distinct second copy in said I/O RAM.” (emphasis added).

51. The office action does not clearly show where the cited prior art teaches explicitly storing “a distinct second copy” of processed data after the results have already been processed, nor does it clearly show where “the CPU results are written directly to first instance...and not to the distinct second copy in said I/O RAM.” Further the office action does not show where the prior art clearly teaches the discovery that taking the time and resources to make “a distinct second copy” leads to the result of “increasing image procession performance” over convention

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methods. Thus the office action has not shown where subject matter of claim 12 as a whole, including its differences over the prior art, would have been obvious.

Claim 16

52. Claim 16 claims a "machine for image processing...wherein said image data is copied from said I/O device to a second copy of said image data in a buffer in said main memory prior to being processed by said processor or wherein said processor processes said image data using a buffer in said main memory before copying the processed image data from said main memory to said I/O device, whereby image processing time is reduced." (emphasis added).

53. The office action does not clearly show where the cited prior art teaches explicitly copying "a second copy" of a image that is already in I/O RAM, nor does it clearly show where the extra second copy is made by "is copied...prior to being processed by said processor" or "said processor processes said image data using a buffer in said main memory before copying the processed image data to said I/O device." Further the office action does not show where the prior art clearly teaches the discovery that taking the time and resources to make "a second copy" leads to the result where "image processing time is reduced" over convention methods. Thus the office action has not shown where subject matter of claim 16 as a whole, including its differences over the prior art, would have been obvious.

Claim 22

54. Claim 22 claims a "machine for image processing..." which includes "a means for copying said image data from said input device to a second copy of said image data in a buffer in said main memory prior to being processed by said processor, whereby image processing time is

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reduced compared to the image processing time required if the processor processed the first copy of the image data in the input device.” (emphasis added).

55. The office action does not clearly show where the cited prior art teaches a means for copying to “a second copy” of image data that is already in I/O RAM, nor does it clearly show where the extra second copy is made by “prior to being processed by said processor.” Further the office action does not show where the prior art clearly teaches the discovery that taking the time and resources to make “a second copy” leads to the result where “image processing time is reduced compared to the image processing time required if the processor processed the first copy of the image data in the input device.” Thus the office action has not shown where subject matter of claim 22 as a whole, including its differences over the prior art, would have been obvious.

Claim 26

56. Claim 26 claims a “machine for image processing” including “a means for copying, after said processor generates a first set of image data in said main memory, said first set of image data from said main memory to a second copy of said image data in said output device, whereby image processing time is reduced compared to the image processing time required if the processor generated the image data directly in said input device instead of said main memory.” (emphasis added).

57. The office action does not clearly show where the cited prior art teaches a means for copying to “a second copy” of image data that is already in I/O RAM, nor does it clearly show where the extra second copy is made by “prior to being processed by said processor.” Further the office action does not show where the prior art clearly teaches the discovery that taking the

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time and resources to make "a second copy" leads to the result where "image processing time is reduced compared to the image processing time required if the processor processed the first copy of the image data in the input device." Thus the office action has not shown where subject matter of claim 26 as a whole, including its differences over the prior art, would have been obvious.

N. Dependent Claims At Least Allowable

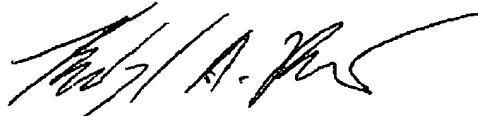
58. Applicant submits that the independent claims may all be distinguished over the cited prior art as discussed above. Further all of the dependent claims would be allowable for at least the same reasons that the claims upon which they depend are allowable. Further, at least some of the dependent claims included novel features, such as discussed above regarding specific claims, and various ways in which the memcopy function is used which results in further improvements to the image processing performance than was unexpected by the prior art.

O. Reconsideration Requested

59. The undersigned respectfully submits that, in view of the foregoing remarks, the rejections of the claims raised in the Office Action have been fully addressed and overcome, and the present application is believed to be in condition for allowance. It is respectfully requested that this application be reconsidered, that these claims be allowed, and that this case be passed to issue. If it is believed that a telephone conversation would expedite the prosecution of the present application, or clarify matters with regard to its allowance, the Examiner is invited to call the undersigned inventor at 408-739-9517.

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Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Kendyl A. Roman', written over a horizontal line.

Kendyl A. Roman
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Date: March 27, 2007